Multi-Resolution Simulation Assignment (MRSA)

Dynamic Traffic Assignment #2

"Put Dynamic Traffic Assignment to Work"

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October 23, 2009

Outline

- Introduction
- MRSA
  - What is MRSA?
  - Why is it so important?
  - General concept
- Case Studies
  - Truck lane restriction
  - Design alternatives for interchange direct connects
  - Construction sequencing for freeway widening
  - Mitigation strategies for corridor "hot-spots"

Introduction

- Integrating travel demand models, dynamic traffic assignment (DTA) models and microscopic traffic simulation models can be advantageous for region-wide operational planning projects
  - TDM provide blueprint and O/D
  - DTA – region-wide estimation of traffic redistribution
  - Microscopic – local operational analysis

Introduction

- Model integration synergizes the strengths of all models
- Which model resolution integration suits situation best
  - Understanding what you are trying to model
- Challenges remain in model translation and interface
  - Consistency
  - Model feedback

Simulation-Based Dynamic Traffic Assignment (SBDTA)

- Addresses issues that may fall beyond the reach of both:
  - Macroscopic models: (large scale but static) typically used by transportation planners for long-range planning
  - Microscopic models: (dynamic but small-scale) typically used by traffic engineers for traffic studies
  - SBDTA – dynamic and large-scale
- The scenarios of interest may result in shifts of network or corridor-wide traffic flow patterns
  - Significant change to roadway configuration
  - Certain corridor management strategies

What is MRSA?

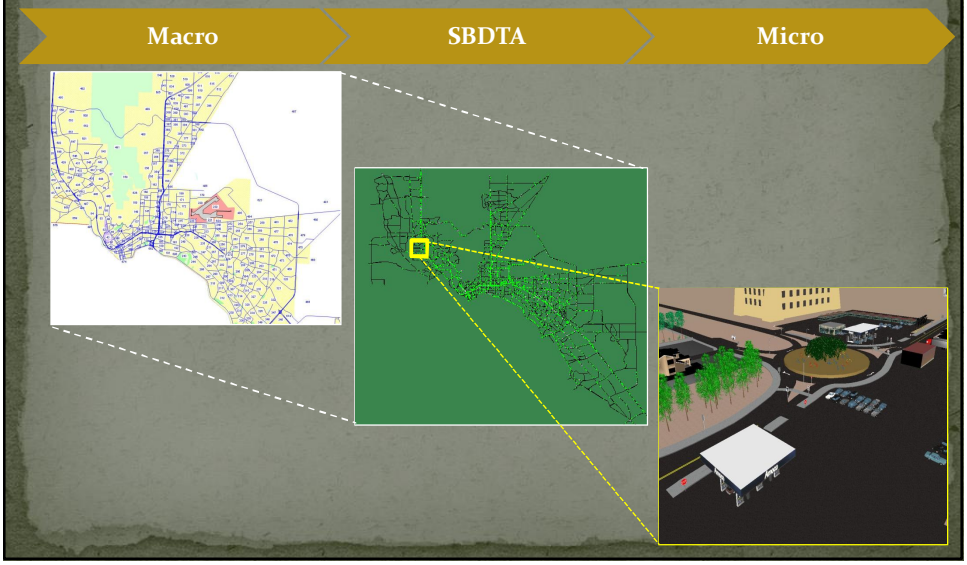
- Integrating macro, DTA and micro traffic analysis tools with different levels of resolution and capabilities for the purpose of achieving a specific goal
  - Analyze network at both the system-wide and localized levels simultaneously

	Dynamic		Static
	0.1-1 second	5-10 seconds	
Intersections	Micro Sim		
Corridor	Micro Sim	DTA	
Regional		DTA	TDM

Why is MRSA so Important?

- Macro, DTA and micro models are not mutually exclusive
- They are complimentary to one another and can accomplish optimal modeling capabilities
- Retain the best characteristics of each model
  - Incorporate multiple trip purposes
  - Realistic representation of regional traffic and rerouting based upon network conditions
  - Detailed interactions

Macro-SBDTA-Micro Integration

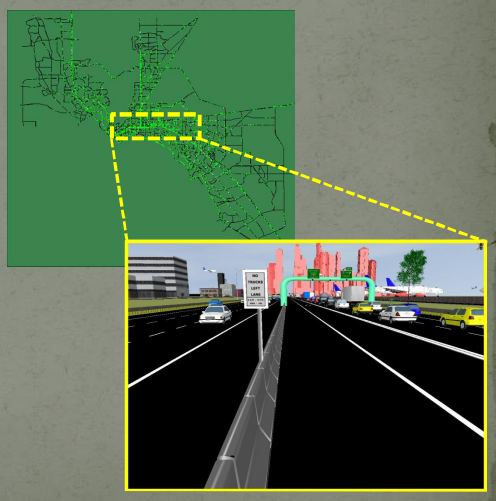


Case Study 1

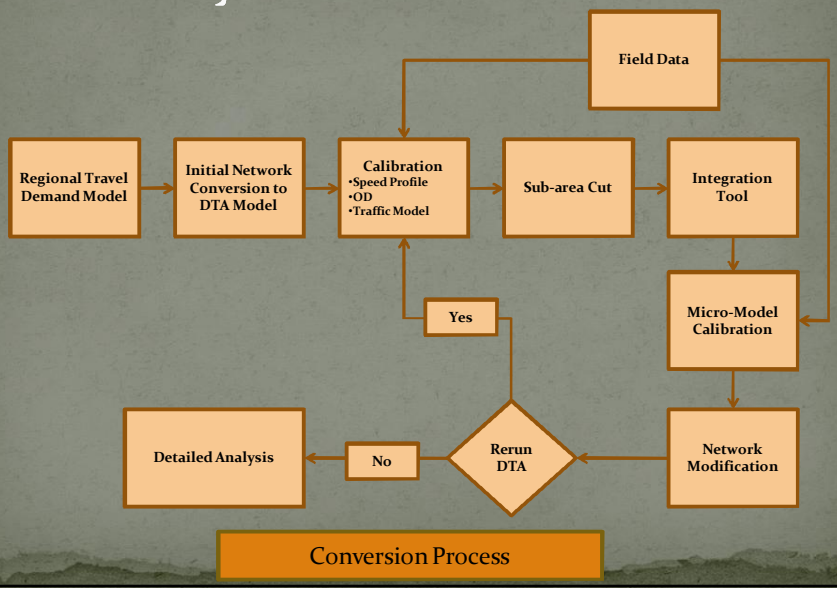
- Truck restricted lanes
  - Analyze the effectiveness of restricting trucks from left-most fast lane on freeway
  - 22-mile corridor of I-10 in El Paso, TX
  - Analyze a.m. peak, p.m. peak, & mid-day
  - Determine benefits
    - Speed on left-most lane
    - Acceleration/Deceleration patterns
    - Vehicle interactions at merge areas
    - Does grade play a significant role on truck speeds?
- How do you model this?

Case Study 1

- DTA model estimates region-wide truck and car trajectories (time-dependent paths and flows)
- Micro model gives detailed I-10 truck lane operations with truck trajectories



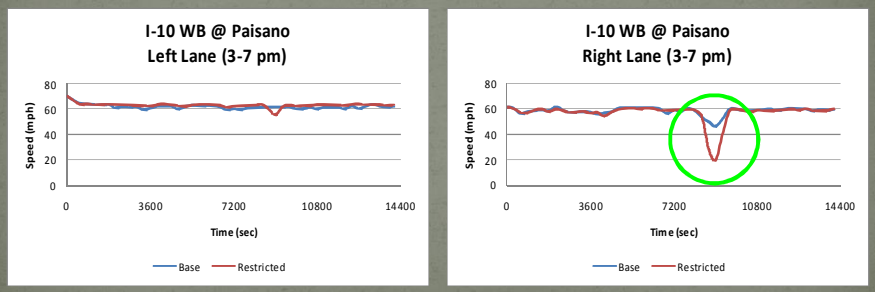
Case Study 1



Conversion Process

Case Study 1

- Results showed that restricting trucks from left-most fast lane had slight improvement on speeds.
- Identified section of freeway where restrictions had adverse affect on freeway speeds



Speed – Left vs. Right Lane

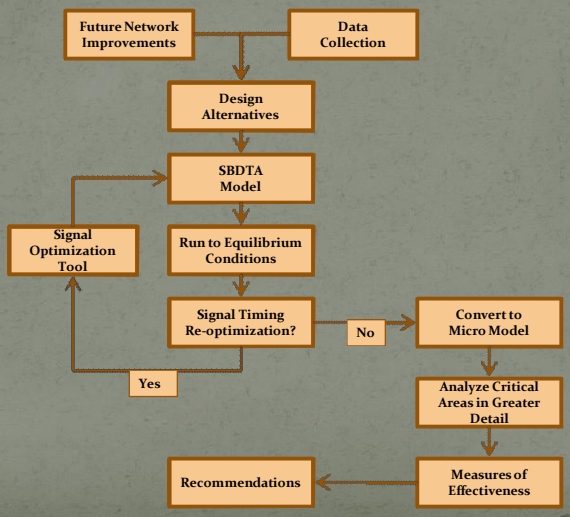
Case Study 2

- Texas Department of Transportation looking at alleviating congestion at diamond interchange and surrounding arterials in El Paso, TX.
- Propose 7 different design alternatives for direct connects
- Two sets of designs are identical except for direct connect lane access
- Corridor has heavy truck usage

Case Study 2

- TxDOT wants to know which alternative is most viable option?
- How does weaving at merge areas affect traffic on I-10?
- Analyze both the localized traffic impact and regional traffic redistribution
- Which model do you use?
  - Travel demand model?
  - DTA model?
  - Microscopic model?

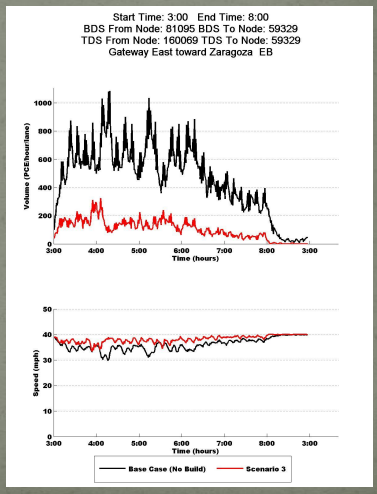
Case Study 2



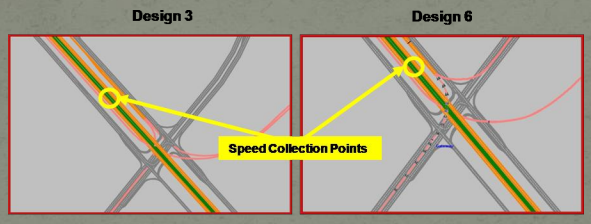
Case Study 2

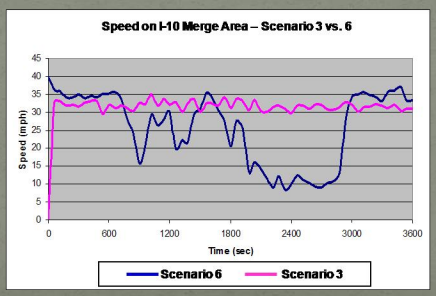
- Scenario 3 performed the best when considering traffic flow, overall travel times and construction costs.
- Queuing on frontage road was significantly reduced.
- Reduction in delay & travel time.

SBDTA Output



Case Study 2



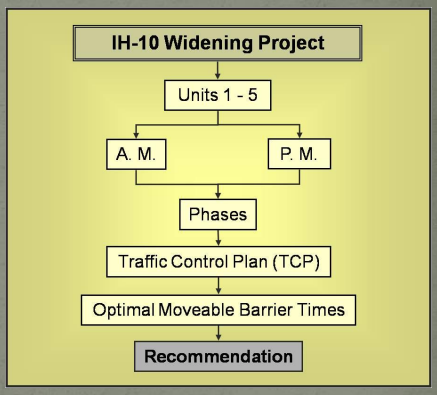


Case Study 2

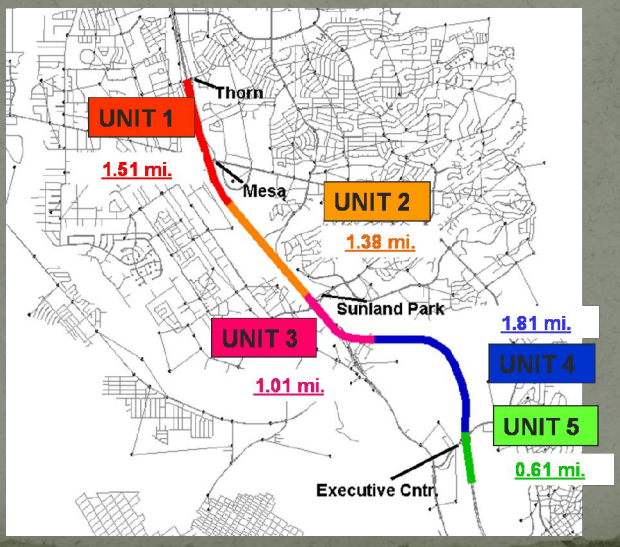
- DTA model was able to show shifts in traffic based upon each design alternative.
  - Queuing on arterials and frontage roads
  - Speed fluctuations during peak hours
- Micro model was able to identify "hot-spot" areas where direct connects merge
- Micro model was used to determine whether or not grade played a major role on trucks entering freeway.

Case Study 3

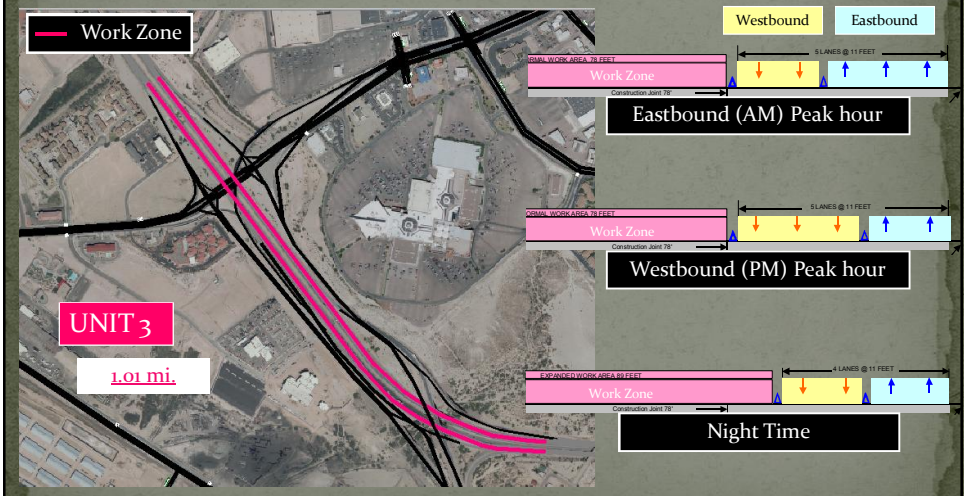
- Construction sequencing for addition of freeway lane
  - TxDOT wants to widen section of I-10 in western portion of El Paso
  - Construction divided into 5 section areas
  - Determine optimal construction sequencing for TCP with moveable barriers



Case Study 3



Case Study 3



Use DTA model to determine both short and long-term impacts due to work zone

Case Study 3

- DTA was able to evaluate effectiveness of TCPs
- Identify optimal construction sequencing of phases.
- Identify hotspots during peak and off-peak periods
- Evaluate possible mitigation strategies to help reduce congestion.

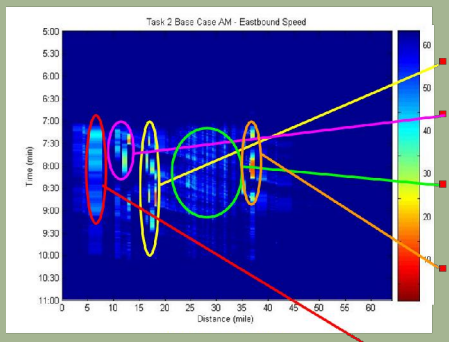
Case Study 3

- Microscopic model was used to analyze areas of concern at a higher fidelity of resolution
  - Weave/merge areas
  - Optimize signal timings on adjacent arterials and feedback to DTA model

Case Study 4

- Analysis of Mitigation Strategies for I-10 Corridor Hot-Spots
  - Routing strategies
    - Proposed connection between I-10 and border highway
    - Elevated super arterial with direct connects to I-10
  - Operational strategies
    - Ramp closure
    - X-ramps
    - Collector/distributor at existing diamond interchange

Case Study 4



- Sunland Park – 7:30am to 8:00am
- Schuster 8:00am to 9:30am
- Airway to Lee Trevino – 7:15am 9:00am
- Horizon – 7:30am to 8:15am

LISTED HOT SPOTS

Schuster
- Extended speed reduction, but narrow small in distance

Sunland Park
- Specifically the new Interchange connecting from Mesa
- Speed reduction leads to Executive

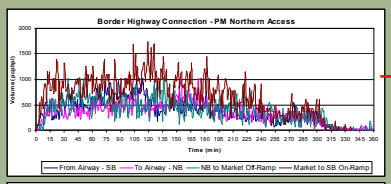
Trowbridge to Lomaland
- Particularly heavier near Geronimo and Airway
- Constant speed at 45mph for almost two-hour period

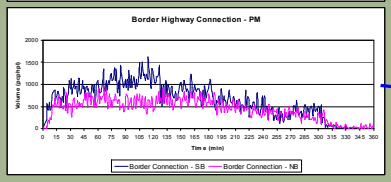
Eastlake
- From Zaragoza to Eastlake
- Average volume of 1200 pcphpl on the off-ramp
- WB traffic looks busy in the same area (next slide)
- Eastlake could become busy

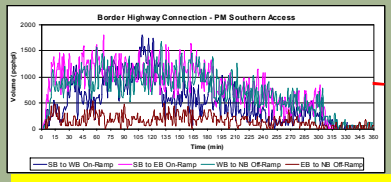
Vinton/Transmountain
- Long link (exaggerated)
- There is still a reduction in speed which is worth noting

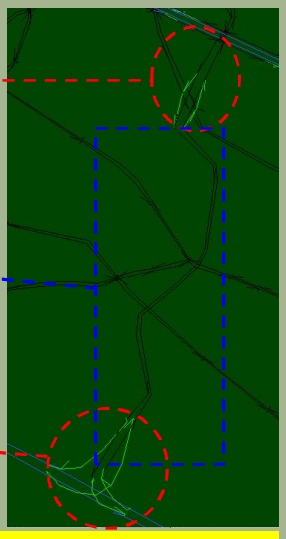
Use base DTA model to identify "hot-spots"

Case Study 4



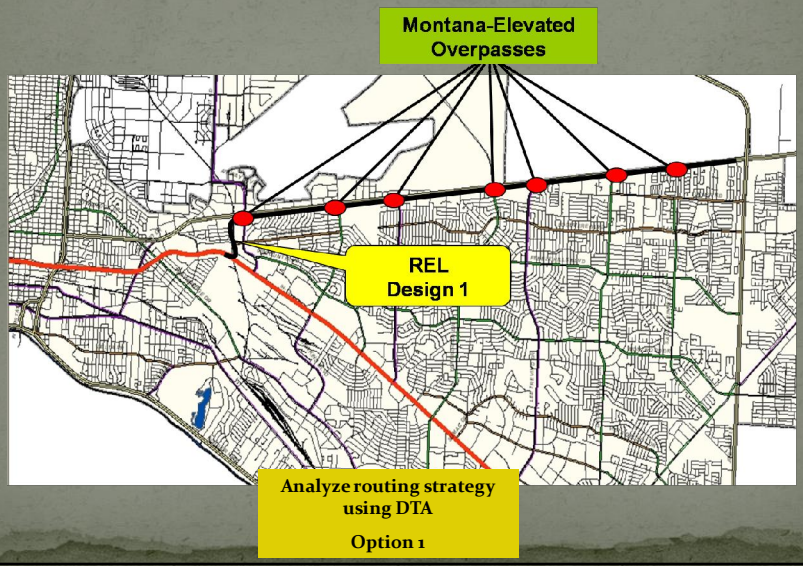






Graphs represent the volumes experienced on proposed Border Highway Connections (PM)

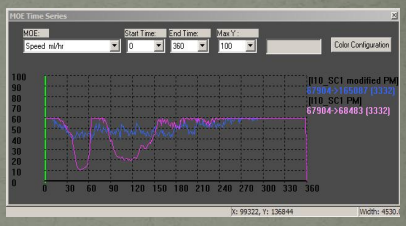
Case Study 4



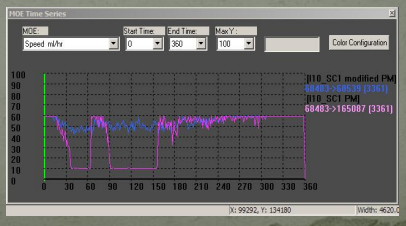
Case Study 4

- AM
  - Little improvement for eastbound traffic
  - WB traffic merging into freeway acts like an incident (worse congestion between Hawkins and Airways)
- PM
  - Significant improvement of traffic flow on freeway EB (Geronimo entrance ramp does not create turbulent friction with DC)

Speed comparison of I-10 EB each before the REL direct connects location



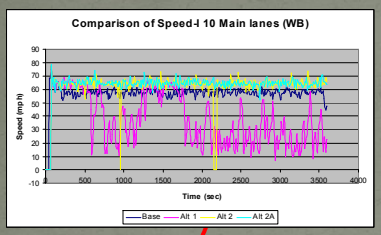
Speed comparison on I-10 after the EB Geronimo On-Ramp

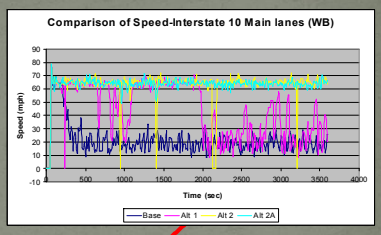


Case Study 4

- Operational strategy
  - Analyze design alternatives for ramps
    - Move on-ramp further west
    - Reconfigure to an "X" ramp
    - Create auxiliary lane on WB frontage road
  - Use traffic flows and paths from DTA model as input for micro-simulation model

Case Study 4





Analyze operational strategy using micro model

Questions ??

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